SPECIAL MEETING
CITIZENS’ FLOOD ZONE COMMITTEE
TUESDAY, FEBRUARY 27, 2018 6:00 P.M.
CITY HALL COUNCIL CHAMBERS
450 SAN RAFAEL AVENUE
BELVEDERE, CALIFORNIA

AGENDA

OPEN FORUM

This is an opportunity for any citizen to briefly address the Committee on any matter that does not appear on this agenda. Upon being recognized by the Chair, please state your name, address, and limit your oral statement to no more than three minutes. Matters that appear to warrant a more lengthy presentation or Committee consideration will be agendized for further discussion at a later meeting.

SCHEDULED ITEMS

1. Approve minutes of the October 11, 2017, meeting of the Citizens’ Flood Zone Committee

2. Update on the Department of Water Resource grant and discussion on the Phase 1 Alternatives Analysis for the Belvedere Lagoon Coastal Levee System Evaluation project.
   Staff recommendation: Consider the progress report and support recommendation to the City Council to approve the Phase 1 levee raise alternative design option.

ADJOURN

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Posted: 02/22/2018
REGULAR MEETING
CITIZENS’ FLOOD ZONE COMMITTEE
WEDNESDAY, OCTOBER 11, 2017, 6:30 P.M.
COUNCIL CHAMBERS
450 SAN RAFAEL AVENUE, BELVEDERE, CA

MINUTES

COMMITTEE PRESENT: Andrew Allen, Robert Huret, Glen Isaacson, Ken Johnson, David Rhoades, Bruce Sams, Walter Strycker, Connie Wiley, Marty Winter, and Chair Thomas Cromwell

COMMITTEE ABSENT: Jim Allen, Stewart Bewley, Bob McCaskill, John Parsons, and James Robertson

OTHERS PRESENT: City Clerk Alison Foulis, Stetson Engineer James Reilly, Miller Pacific Engineer Scott Stephens, and City Manager Craig Middleton

CALL TO ORDER OF REGULAR MEETING

The meeting was called to order at 6:30 PM.

Chair Cromwell provided an overview of the Committee’s history and past projects.

OPEN FORUM

No one wished to speak.

SCHEDULED ITEMS

1. Approve minutes of the March 9, 2016, meeting of the Citizens' Flood Zone Committee

   At the end of the meeting, the minutes were unanimously approved as presented.

2. Update on the Department of Water Resource grant and Seawall Structural Analysis; initial discussion of Alternatives Analysis and project timeline.

   Stetson Engineer James Reilly reviewed the progress of work completed under the Department of Water Resources (DWR) grant and summarized work previously completed
under a separate grant to identify the pathway of flooding, develop tools for flood analysis, and form a baseline solution. Mr. Reilly stated that one idea is to raise levees to above stillwater level to stop continuous flow during a 100-year coastal event. The Committee discussed levee adjustment possibilities. Mr. Reilly reviewed the grant funding and the grant implementation plan with the Committee, along with the current budget standings. The Committee discussed sea level rise history and projections and outside regulatory agency review of potential projects.

Scott Stephens, Miller Pacific Engineer, discussed the current state of Beach Road, including long-term separation issues, and recommendations for remediation. Mr. Stephens also shared a geotechnical evaluation progress report. The Committee discussed levee design options and other overtopping prevention measures such as off-shore shelf wetlands, submerged gates, wave attenuation barriers, and vertical gates.

Chair Cromwell called for public comment.

Larry Stoehr, Lagoon resident, asked questions regarding the Lagoon’s capacity in a 100-year flood situation.

Seeing no one else wishing to speak, Chair Cromwell closed the public forum.

The Committee discussed meeting in the coming months for another update on the DWR grant process.

**Adjourn**

The meeting was adjourned at 7:46 PM.

**THE FOREGOING MINUTES** were approved at a regular meeting of the Citizens’ Flood Zone Committee on _____________, by the following vote:

**AYES:**
**NOES:**
**ABSENT:**
**ABSTAIN:**

**APPROVED:___________________________**
Thomas Cromwell, Chair

**ATTEST:_____________________________**
Craig Middleton, City Manager
TO: Citizens’ Flood Zone Committee  
FROM: Craig Middleton, City Manager  
Robert Zadnik, Public Works Manager  
James Reilly, Stetson Engineers  
SUBJECT: Initial Screening of the Phase 1 Alternatives Analysis for the Belvedere Lagoon Coastal Levee System Evaluation

Recommended Motion/Item Description

1. Consider the progress report and provide staff with comments or recommendations.

2. That the Committee support Staff’s recommendation to City Council to approve the Phase 1 levee-raise alternative design option.

Background

At the October 2017 Citizens’ Flood Zone Committee (CFZC) meeting, City staff and James Reilly (Stetson Engineering) presented an update on the structural investigation of the seawalls, and included an overview of the upcoming Alternatives Analysis component of the Department of Water Resource (DWR) grant.

The purpose of this follow-up report is to cover the analysis of potentially feasible types of flood protection methods for the Belvedere Lagoon area. In this report, types of flood protection methods are identified, evaluated, screened, and the preferred type is recommended based on relevant selection criteria. Types of flood protection methods are divided into traditional and non-traditional methods located on-shore and off-shore.

This evaluation focuses on flood control in the Lagoon area. Lagoon shoreline properties are vulnerable to flooding from rain-induced stormwater runoff or coastal overtopping of the San Rafael Avenue and Beach Road levees. Floodwaters entering the lagoon from these two sources can cause the lagoon water level to rapidly rise and flood shoreline properties. In 2014, using a
FEMA Cooperative Technical Partner program grant ("FEMA CTP grant"), Belvedere completed a study of the Belvedere Lagoon Coastal Levee System. The levee system includes the San Rafael Avenue and Beach Road levees, Lagoon water control facilities, and storm drains that discharge to the Lagoon, all of which affect flooding in the Lagoon area. The FEMA CTP Grant Study found that the levee system has sufficient capacity and capability to protect Lagoon shoreline properties from flooding caused by rain-induced stormwater runoff entering the Lagoon. However, the levee system could not protect properties from flooding caused by coastal overtopping of the levees. The study found that the San Rafael Avenue and Beach Road levees would need to be raised, or some other method implemented, to reduce coastal overtopping sufficiently to prevent the Lagoon from rising to flood levels.

The DWR LLAP/LOLE grant will build upon the work done under the FEMA CTP grant to develop an effective, practical, and affordable project that provides flood protection for the Lagoon area. The ultimate project, referred to as the Belvedere Lagoon Coastal Levee System Improvement Project, will need to be resilient and adaptable to future sea level rise in accordance with “State of California Sea-Level Rise Guidance: 2018 Update.” Additionally, this project will require a permit from the San Francisco Bay Conservation and Development Commission (BCDC), the California state planning and regulatory agency with regional authority over the San Francisco Bay. The BCDC permitting process will have a major influence on the ultimate type and configuration of the project. As a permit condition, BCDC requires that projects be resilient and adaptable to future sea level rise. City staff and consultants held a pre-application meeting with BCDC staff on December 14, 2017, regarding the DWR-grant-funded Belvedere Lagoon Coastal Levee System Evaluation. Highlights from that meeting are included below.

The overall grant scope of work consists of structural and geotechnical evaluation of the condition of the Belvedere Lagoon Coastal Levee System and planning and pre-design work related to levee raising and possible modifications to other system components, or other methods that avoid or minimize levee raising, needed to protect the lagoon from rising to flood levels during the design flood. The design flood is the 1% annual chance coastal flood with associated rain-induced stormwater runoff. The scope of work has four major elements:

- **Geotechnical and coastal structural investigation**, analysis, and evaluation of the stability of the existing levees to withstand a 1%-annual-chance coastal flood event, identification of deficiencies in the levees, and recommendations for corrective measures;
- **Alternatives analysis** of raising all or portions of the levees to sufficiently reduce or eliminate overtopping from the 1%-annual-chance coastal flood event and other system component modifications, or other methods that avoid or minimize levee raising;
- **Feasibility study** of the preferred method selected in the alternatives analysis;
- **Environmental documentation** to comply with CEQA and NEPA and obtain required environmental regulatory permits for the preferred method.

To date, CLE has completed the Phase 1 coastal structural evaluation and MPEG has completed the Phase 1 geotechnical evaluation.
Findings

The following present highlights from the Geotechnical Evaluations of the seawalls, information learned from staff’s December meeting with the BCDC, and the most current sea level rise predictions from the California Natural Resources Agency.

- Findings of Phase 1 Geotechnical and Coastal Structural Evaluations
  
  o The San Rafael Avenue and Beach Road levees were constructed many years ago using variable earthen materials.
  o Both levees are underlain by “Bay Mud” and sands which are compressible and prone to liquefaction and settlement.
  o Both levees have undergone over four feet of settlement since construction.
  o Future settlement is expected – 0.5 ft over the next 30 years and 1.2 ft over the next 100 years. Need to raise levees higher to account for future settlement.
  o Both levees are stable under static conditions, but are not stable during seismic ground shaking. Potential displacement of 3 to 24 inches could occur.
  o Further lowering of the levees due to future settlement and/or seismic ground shaking-induced (vertical) displacement would exacerbate the height deficiency of the levees, rendering them more vulnerable to coastal overtopping.
  o Placement of additional fill or other material to raise the levees will increase future settlement because of the underlying compressible soils.
  o Armor stone placed along the outboard slope of San Rafael levee provides adequate protection and is stable to withstand a 1% annual chance coastal flood event. The levee is, nonetheless, height deficient to prevent coastal overtopping.
  o Railing sections along the Beach Road levee can be expected to fail during a 1% annual chance coastal flood event. Railing fill-in along open railing sections would be cost prohibitive and not sufficient to prevent failure. Railing sections should be replaced and retractable flood gates installed across property entrances.
  o The foundation of the sea wall along a portion of the Beach Road levee is exposed and being undermined by wave action. The seawall is losing lateral support, some sections are actively sliding/rotating. This condition will continue to deteriorate. Deeper foundation support is needed, and driven sheet piles are the best option. Pile depths of 30 to 40 ft deep would protect against further undermining while providing support and reducing lateral deformation during strong seismic shaking. The sea wall must be repaired to restore stability. The repair should be compatible and, to the extent practical, integrated with potential future raising of the levee.

- Highlights of December 14, 2017, Meeting with BCDC Regarding the DWR Grant Project
  
  o In general, BCDC’s permitting authority covers the San Francisco Bay and the shoreline band. Along the San Rafael Avenue and Beach Road levees, BCDC’s permitting authority extends from the outboard side of the levees a distance of 100 ft inward towards the lagoon (shoreline band), but it does not include the lagoon. Any modifications to the levees, including raising, will require a permit from BCDC.
BCDC indicated that they

- support raising and widening the levees (and roads), if needed
- would prefer the project provide maximum feasible public access, such as roads and public pathways; at a minimum public access and recreational use should be preserved, not diminished
- require the San Rafael levee park use be preserved, not diminished
- prefer that the project footprint be confined to within the 100 ft shoreline band; extending the footprint outward into the bay would require demonstration that there is no other practicable alternative
- request the permit application include a long term plan for maintaining levee functions under future sea-level rise conditions beyond end of century. Functions include flood protection to interior properties, access and evacuation routes for Belvedere Island residences, and corridors for utilities. Alternatively, consider potential long term future construction of a causeway to replace San Rafael and Beach Road levees to connect Belvedere Island, raising lagoon shoreline properties, filling the lagoon, or future retreat from the lagoon area. BCDC would rely on the State guidance on sea-level rise for setting future sea-level rise conditions.

- Highlights of “State of California Sea Level Rise Guidance: 2018 Update”

  - This State guidance document on sea level rise is scheduled for adoption by the State in March 2018. Its purpose is to provide a science-based methodology for State and local governments to analyze and assess the risks associated with sea level rise and incorporate sea level rise into their planning, permitting, and investment decisions. SB 379 requires local governments to incorporate climate adaptation and resiliency strategies into their General Plan.

  - Probabilistic projections for the height of future sea level rise in the San Francisco Bay are presented in the guidance document. The median (50%) probability projection is 0.9 ft rise by mid-century (2050) and 1.6 to 2.5 ft by end of century (2100). New scientific evidence has highlighted the potential for extreme sea level rise. The extreme projection, which results from loss of the West Antarctic ice sheet and does not have an associated probability, is 2.7 ft rise by mid-century and 10.2 ft rise by end of century.

Alternatives Analysis

The Alternatives Analysis is currently underway. This analysis is following a two-phased approach. The first phase has been completed and is currently scheduled to be reported to the City Council at their March 12, 2018, meeting.

Phase 1
In the first phase, a range of potentially feasible general types of flood protection methods were identified, evaluated, screened, and the preferred type selected. Types of flood protection methods considered included traditional and non-traditional methods located onshore and offshore. Each method considered has the capability of reducing the water level during the 1%
Annual chance coastal flood by either reducing the stillwater or wave runup,\(^1\) or both. Alternative types were placed in two general categories based on placement location (offshore or onshore.)

- **Off-Shore**
  - Coastal marsh shelf, a.k.a. “Horizontal Levee”
  - Structural/Mechanical
    - breakwater
    - submerged gates
    - vertical gates
    - floating wave attenuation barrier (deployable/retractable)

- **On-Shore**
  - Levee raise (permanent)
  - Levee raise (deployable/retractable)
  - Bayside slope modification

At the recommendation of the engineers, nearly all of the offshore types of methods should be screened out because they are too costly to construct and maintain, can interfere with navigation, cause environmental impacts, and would be difficult to permit, particularly from BCDC. Additionally, placement of fill associated with these types of methods would increase future settlement or cause other geotechnical hazards by adding significant weight to underlying compressible soils. Floating wave attenuation barriers (deployable/retractable), extending from the end of the existing concrete breakwater to the opposite shore outboard of the Beach Road levee, was retained as a potential future option to reduce wave runup.

Two of the three onshore types of methods, levee raise (deployable/retractable) and bayside slope modification, should be screened out. Levee raise (deployable/retractable) should be screened out for reasons of high cost to construct and maintain, adding weight and inducing future settlement, and vulnerability to damage arising from levee deformation during strong seismic shaking. Bayside slope modification should also be screened out because of its high cost to construct compared with its limited effectiveness.

Levee raise (permanent) was identified as the preferred type of flood reduction method. Levee raise is effective; is the least costly of all types of methods; could be permitted by BCDC; and could be designed in a way that adds a minimal amount of weight, thereby avoiding inducement of levee settlement. Importantly, levee raise could be designed in a way that is adaptable to future sea level rise.

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\(^1\) Coastal water level can be thought of as having two components: 1) a static component (or assumed static or slowly varying) associated with astronomical tides, storm surges, and wave setup; and 2) a fluctuating component about that static level (swash) associated with surf beat and the motion of individual waves at the shoreline. As used in this report, stillwater means the flood level not including the added effects of waves (wave amplitude and wave setup) or tsunamis, but including storm surge and astronomical tide, and wave runup refers to the height above the stillwater reached by the swash. The component of overtopping by stillwater is continuous, while the component of overtopping by wave runup (swash) is intermittent, pulsating.
Phase 2
The second phase of the alternatives, currently in progress, is focusing on selecting the best configuration for the preferred type (i.e. permanent levee raise). Alternative configurations, varying in terms of location and size/height, are being evaluated. The preferred configuration will be selected for subsequent feasibility-level design and cost estimating, environmental review and regulatory permitting.

As previously stated, the San Rafael Avenue and Beach Road levee tops slightly undulate and range in elevation from a low of about 8.0 ft NAVD to over 10.0 ft NAVD. Previous hydraulic analysis, as documented in the 2014 FEMA CTP Grant Study, indicated that raising the height deficient stretches of the San Rafael Avenue and Beach Road levee tops uniformly to elevation 10.0 ft NAVD and 10.7 ft NAVD, respectively, would reduce overtopping during the 1% annual chance coastal flood sufficiently to prevent the lagoon from rising to flood levels. Additional raising would be needed to account for future sea level rise and additional settlement. Measures to prevent coastal floodwaters from entering the Lagoon through overtopping along the Tiburon waterfront will also likely be needed in order to minimize the height required for the Beach Road levee raise.

Uniform raising of the San Rafael Avenue levee is considered appropriate because there are no buildings on the outboard side of the levee that would be effected by raising. On the other hand, there are several structures on the outboard side of Beach Road levee that may be affected by raising, particularly with regard to building access. For this reason, additional hydraulic analysis was performed to explore non-uniform raising for the purpose of reducing the required levee raise along reaches occupied on the outboard side by buildings. Additional raising needed to account for future sea level rise and additional settlement and measures to prevent floodwater from entering the lagoon from Tiburon were also considered in the analysis. The results of the analysis will be presented at the Citizens’ Flood Zone Committee on Tuesday, February 27th.

Recommendation

1. Consider the progress report and provide staff with comments or recommendations.

2. That the Committee support Staff’s recommendation to City Council to approve the Phase 1 levee-raise alternative design option.

Attachments

- DWR LLAP Grant Implementation Plan
- Beach Road Seawall Conceptual Design.
# DWR LLAP Grant Implementation Plan

<table>
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<tr>
<th>Timeline</th>
<th>Task</th>
<th>Outcome</th>
<th>DWR’s Cost Share (55%)</th>
<th>City’s $ Cost Share (45%)</th>
<th>Cumulative $ *</th>
<th>Total $ Cost*</th>
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<td>Phase 1 Geotechnical and Coastal Structural Evaluation of Existing Levees</td>
<td>Identify deficiencies, describe remedial measures, estimate costs</td>
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<td>5 months</td>
<td>Feasibility Study and Phase 2 Geotechnical and Coastal Structural Evaluation of Modified Levees</td>
<td>Prepare feasibility-level design and estimate cost for preferred alternative w/sea level rise adaptability</td>
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* Does not include City’s in-kind contribution (staff time) of approximately $25,000.